

COMMENT

The substitute specification and claims 35, 41, 47 and 52 have been amended to correct a typographical error contained in the application as originally filed. Specifically, throughout the claims and specification, the term --reducing-- has been substituted for the term "reducible". The **REMARKS** forming part of the response filed July 10, 2003, are to be disregarded and the following **REMARKS** considered. The following **REMARKS** are identical to the **REMARKS** forming part of the response filed July 10, 2003, except that the term --reducing-- has been substituted for the term "reducible".

REMARKS

In view of the above amendments and following remarks, reconsideration and further examination are requested.

The specification and abstract have been reviewed and revised to make editorial changes thereto and generally improve the form thereof, and a substitute specification and abstract are provided. No new matter has been added by the substitute specification and abstract.

New formal drawings are provided for Figures 1, 5 and 14 to make these figures more consistent with the written description of the invention. In this regard, in Figure 1, the lead line from "41" is now shown to extend to an electrode within chamber "7". In Figure 5, reference numeral --36a-- has been provided to designate the first connecting member. And, in Figure 14, reference numeral --102-- has been provided, reference numeral "115" to the right of reference numeral "114" has been deleted, and reference numeral "100" at the top of this figure has been changed to reference numeral --101--.

The instant invention pertains to a hydrothermal electrolytic apparatus and a method of using this apparatus. In accordance with a first embodiment of the invention, reference is made to Figures 1-4. In this embodiment, the apparatus comprises a reaction cell for electrolyzing an influent containing water and a reducing substance at a temperature of from 100°C to a critical

temperature of the influent and at a pressure that allows the water of the influent to be maintained in a liquid phase. The reaction cell includes at least two tubular reaction cells 31 each having a metal inner wall 31a that serves as a cathode, and an anode 41 in each of the at least two tubular reaction cells. The arrangement of a cylindrical metal inner wall as a cathode and an anode surrounded by this metal wall, allows for a surface area of these electrodes to be increased relative to known hydrothermal electrolytic apparatus such that a large amount of influent can be continuously and efficiently electrolyzed. Claims 35 and 47 are believed to be representative of this embodiment of the invention.

In accordance with a second embodiment of the invention, reference is made to Figures 5-9. In this embodiment, like in the first embodiment, the hydrothermal electrolytic apparatus comprises a reaction cell that is for electrolyzing an influent containing water and a reducing substance at a temperature of from 100°C to a critical temperature of the influent and at a pressure that allows the water of the influent to be maintained in a liquid phase. In this embodiment, the reaction cell includes a first electrode having concentrically arranged cylindrical first side walls 37a and a first connecting member 36a that interconnects the first side walls, and a second electrode having concentrically arranged cylindrical second side walls 37b and a second connecting member 36b that interconnects the second side walls. The first side walls 37a and the second side walls 37b are alternately arranged so as to form a channel therebetween for passage of the influent. As with the first embodiment, the arrangement of the first and second electrodes in this embodiment allows for a surface area of these electrodes to be increased relative to surface area of electrodes of a conventional hydrothermal electrolytic apparatus such that a large amount of influent can be continuously and efficiently electrolyzed. Claims 41 and 52 are believed to be representative of this embodiment of the invention.

Additionally, to further increase the surface area of the electrodes, with regard to either of the embodiment conductive particles can be added to the influent to thereby supply a larger amount of electricity which enables more efficient electrolyzing of large amounts of influent.

The instant invention is based on Applicants' recognition that, contrary to what is expected, the increased surface area of the electrodes does not result in an explosive condition

during hydrothermal electrolysis. In this regard, it is well known in the art of electrolysis that when electricity is applied to an aqueous medium to conduct electrolysis, hydrogen gas and oxygen gas are generated at an anode and cathode, respectively. Therefore, those skilled in the art would expect that if a large amount of electricity is supplied (by increasing surface area of electrodes, for example) during hydrothermal electrolysis conducted at a high temperature and high pressure, generated hydrogen gas and oxygen gas would be mixed under a high-temperature and high-pressure condition to create a very dangerous explosive atmosphere. Accordingly, those skilled in the art would not consider increasing a surface area of electrodes in a hydrothermal electrolytic apparatus so as to increase an amount of electricity to be supplied to the apparatus while performing hydrothermal electrolysis.

The present inventors have found that generation of hydrogen gas and oxygen gas is highly suppressed during high-temperature and high-pressure hydrothermal electrolysis such that the aforementioned explosive condition does not exist. Based on this finding, the present inventors have developed a large-scale hydrothermal electrolytic apparatus having an enlarged surface area of electrodes. Accordingly, hydrothermal electrolysis can be performed more efficiently with the inventive apparatus than with conventional apparatus, while not encountering an explosive condition resulting from mixing of oxygen gas and hydrogen gas under high pressure and high temperature.

The Examiner rejected claims 16 and 21 under 35 U.S.C. § 102(b) as being anticipated by JP '982. The Examiner rejected claims 17, 20, 22 and 25 35 U.S.C. § 103(a) as being unpatentable over JP '982 in view of JP '782. The Examiner rejected claims 18 and 23 under 35 U.S.C. § 103(a) as being unpatentable over JP '982 in view of Gilchrist. The Examiner rejected claims 19 and 24 under 35 U.S.C. § 103(a) as being unpatentable JP '982 in view of Stralser. The Examiner rejected claims 26, 32 and 33 under 35 U.S.C. § 103(a) as being unpatentable over JP '982 in view of SU '212. The Examiner rejected claims 27-29 and 34 under 35 U.S.C. § 103(a) as being unpatentable over JP '982 in view SU '212 and further in view of Hess et al. The Examiner rejected claim 30 under 35 U.S.C. § 103(a) as being unpatentable over JP '982 in view SU '212 and Hess et al., and further in view of Gilchrist. And, the Examiner rejected claim 31 under 35

U.S.C. § 103(a) as being unpatentable over JP '982 in view of SU '212 and Hess et al., and further in view of Stralser. These rejections are respectfully traversed, and the references relied upon by the Examiner are not applicable with regard to the newly added claims for the following reasons.

With regard to the newly added claims, please note that claim 35 generally corresponds to a combination of former claims 16 and 18, and that new claim 41 generally corresponds to a combination of former claims 16 and 19. Accordingly, the rejection of former claim 18 will be discussed as it pertains to new claims 35 and 47, and the rejection of former claim 19 will be discussed as it pertains to new claim 41 and 52.

The Examiner rejected claim 18 as being unpatentable over a combination of JP '982 and Gilchrist. Specifically, the Examiner recognized that JP '982 fails to disclose a reaction cell including at least two tubular reaction cells, and thus relied upon Gilchrist's teaching of tubular reaction cells as shown in Figures 6-9 for concluding that one having ordinary skill in the art would have found it obvious to have applied the method of JP '982 to the apparatus of Gilchrist. This position taken by the Examiner is respectfully traversed for the following reasons.

While JP '982 discloses the basic concept of hydrothermal electrolysis, this reference is silent with regard to any recognition that generation of hydrogen gas and oxygen gas is highly suppressed during high-temperature and high-pressure hydrothermal electrolysis. And, while Gilchrist does disclose multiple tubular electrolytic cells, Gilchrist is silent about generation of hydrogen gas and oxygen gas during electrolysis. The disclosed apparatus of Gilchrist is merely an electro-deposit apparatus that is generally operated at a temperature of 130°F -150°F (54°C - 65°C). Based on conventional knowledge in the art, one skilled in the art would have considered that use of the multiple tubular electrode construction disclosed by Gilchrist to perform the hydrothermal electrolysis of JP '982, as suggested by the Examiner, would result in a very dangerous explosive atmosphere such that one having ordinary skill in the art would not have been motivated to use the device of Gilchrist to perform the method of JP '982. Specifically, it is the high temperature and high pressure obtained during the method of JP '982 that would lead one skilled in the art to believe that an explosive situation would result were the device of Gilchrist used to practice the method of JP '982.

Accordingly, because one having ordinary skill in the art would not have been motivated to practice the method of JP '982 with the device of Gilchrist, former claim 18 and new claims 35 and 47 are not obvious for the reasons as presented by the Examiner. Thus, claims 35 and 47 are allowable. None of the other references relied upon by the Examiner resolve the above deficiencies of JP '982 and Gilchrist, and accordingly, claims 35-40 and 47-51 are allowable.

The Examiner rejected claim 19 as being unpatentable over a combination of JP '982 and Stralser. Specifically, the Examiner recognized that JP '982 fails to disclose the reaction cell as recited in former claim 19 and new claims 41 and 52, and thus took the position that in view of Stralser's teaching of a reaction cell as recited in these claims, one having ordinary skill in the art would have found it obvious to practice the method of JP '982 in the apparatus of Stralser. This position is also traversed for reasons analogous to those expressed above with regard to the combination of JP '982 and Gilchrist.

In this regard, while Stralser does disclose an electrolytic apparatus having concentrically arranged multi-tubular electrodes, Stralser is silent about generation of hydrogen gas and oxygen gas during electrolysis. The apparatus of Stralser is merely operated at a room temperature of 60°F - 80°F (15°C - 26°C). Based on conventional knowledge in the art, one having ordinary skill in the art would have considered that the use of the concentrically arranged multi-tubular electrode reaction cell of Stralser to perform the method of JP '982 would result in a very dangerous explosive atmosphere, and thus would not have considered combining JP '982 and Stralser. Specifically, it is the high temperature and high pressure obtained during the method of JP '982 that would lead one skilled in the art to believe that an explosive situation would result were the device of Stralser used to practice the method of JP '982.

Thus, claim 19 and new claims 41 and 52 are not obvious for the reasons as presented by the Examiner. The remaining references does not resolve these deficiencies of JP '982 and Stralser, and accordingly, claims 41-46 and 52 -56 are allowable.

Additionally, with regard to the Examiner's reliance on JP '782 for a teaching of providing an oxidizer line for supplying an oxidizer to the reaction cell, one having ordinary skill in the art would not have been motivated to combine the teachings of JP '982 and JP '782 because, as

mentioned previously, one skilled in the art would expect addition of an oxidizer, such as oxygen, to the hydrothermal electrolysis method of JP '982 to result in a very dangerous explosive atmosphere, such that one having ordinary skill in the art would not have found it obvious to combine the teachings of JP '982 and JP '782. For this reason, claims 36, 42, 48 and 53 are patentable in their own right.

Similarly, with regard to the Examiner's reliance on SU '212 for a teaching of adding conductive particles to the electrolysis process of JP '982, because one having ordinary skill in the art would have expected the addition of such conductive particles to the process of JP '982 to result in an explosive atmosphere due to the increase of surface area of electrodes, one having ordinary skill in the art would not have sought to combine the teachings of JP '982 and SU '212. SU '212 does not teach or suggest that the conductive particles are to be added to a hydrothermal electrolysis reaction. Accordingly, claims 37, 43, 49 and 54 are patentable in their own right.

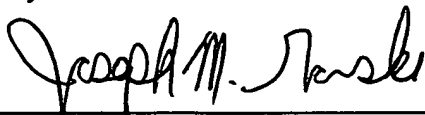
Hess et al. does not resolve any of the above deficiencies, and accordingly, claims 35-56 are allowable for the reasons as expressed above.

In view of the above amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and an early Notice of Allowance is earnestly solicited.

If after reviewing this Amendment, the Examiner believes that any issues remain which must be resolved before the application can be passed to issue, the Examiner is invited to contact the Applicants' undersigned representative by telephone to resolve such issues.

Respectfully submitted,

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July 14, 2003